Soil and land resources in the context of addressing food and energy security through sustainable biomass value chain

Dr. Yeboah Edward
Soil Microbiology Division

C S I R - Soil Research Institute

June, 2017

Soil Resources

- Soil is a non-renewable natural resource. Its preservation is essential for food security and sustainable development of nations.

- Soil is a core component of land resources; it is the basis for food, feed, fuel and fibre production and for many critical ecosystem services.

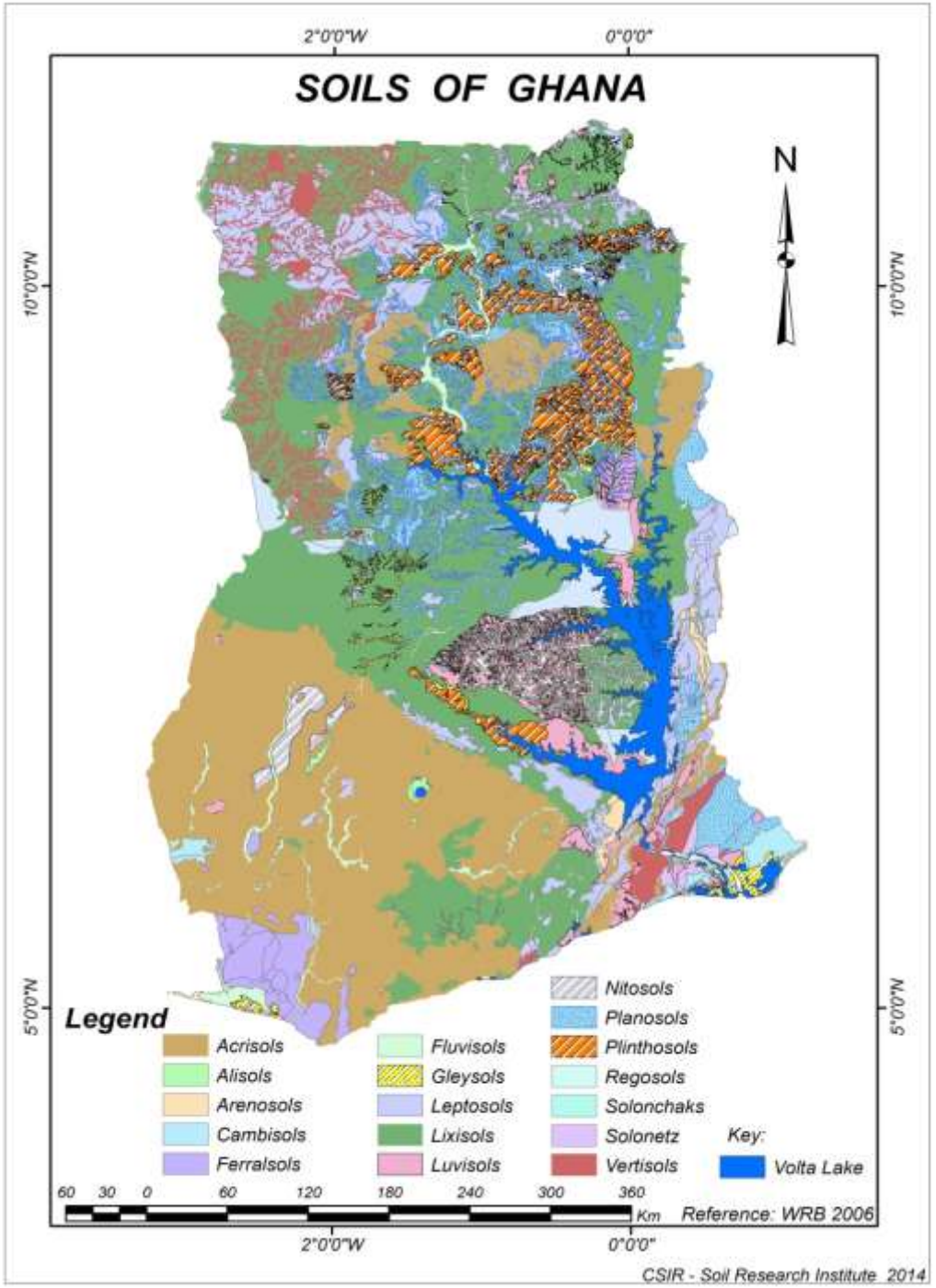
The *SOIL* is vital for sustainable agricultural production and food security.

Soil Resources of Ghana

- Total land area of Ghana is 23,853,900 ha.
- 13,628,179 ha (57.1%) is suitable for agriculture

Nutrient depletion:

- Occurs primarily through crop removal in harvested products and residues, leaching, erosion and N volatilization
- Annual depletion rate is 35 kg N, 4 kg P and 20 kg K ha-1

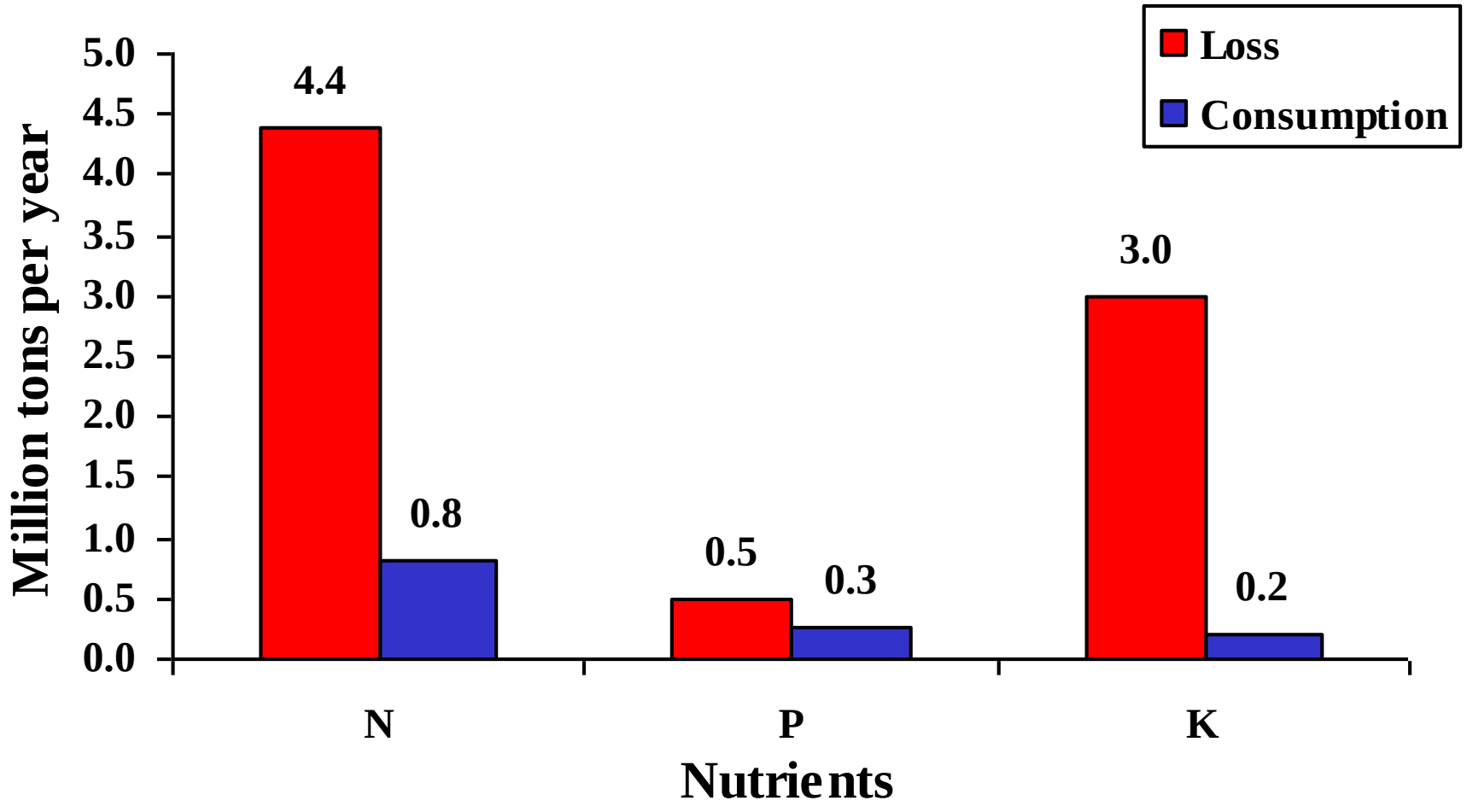


Fertility status of the soils

Agro-Ecological Zones	Soil pH	Organic C	Total N	Available P	Available K
		(%)		(mg/kg soil)	
High Rainforest	3.8 – 5.5	1.52 – 4.24	0.12 – 0.38	0.12 – 5.42	63.57 – 150.41
Forest-Transition	5.1 – 6.4	0.59 – 0.99	0.04 – 0.16	0.30 – 4.68	58.29 – 72.53
Semi-Deciduous Forest	5.5 – 6.2	1.59 – 4.80	0.15 – 0.42	0.36 – 5.22	62.01 – 84.82
Coastal Savanna	5.6 – 6.4	0.61 – 1.24	0.05 – 1.16	0.28 – 4.10	48.02 – 58.71
Guinea Savanna	6.2 – 6.6	0.51 – 0.99	0.05 – 0.12	0.18 – 3.60	46.23 – 55.27
Sudan Savanna	6.4 - 6.7	0.48 – 0.98	0.06 - 0.14	0.06 – 1.80	36.96 – 44.51

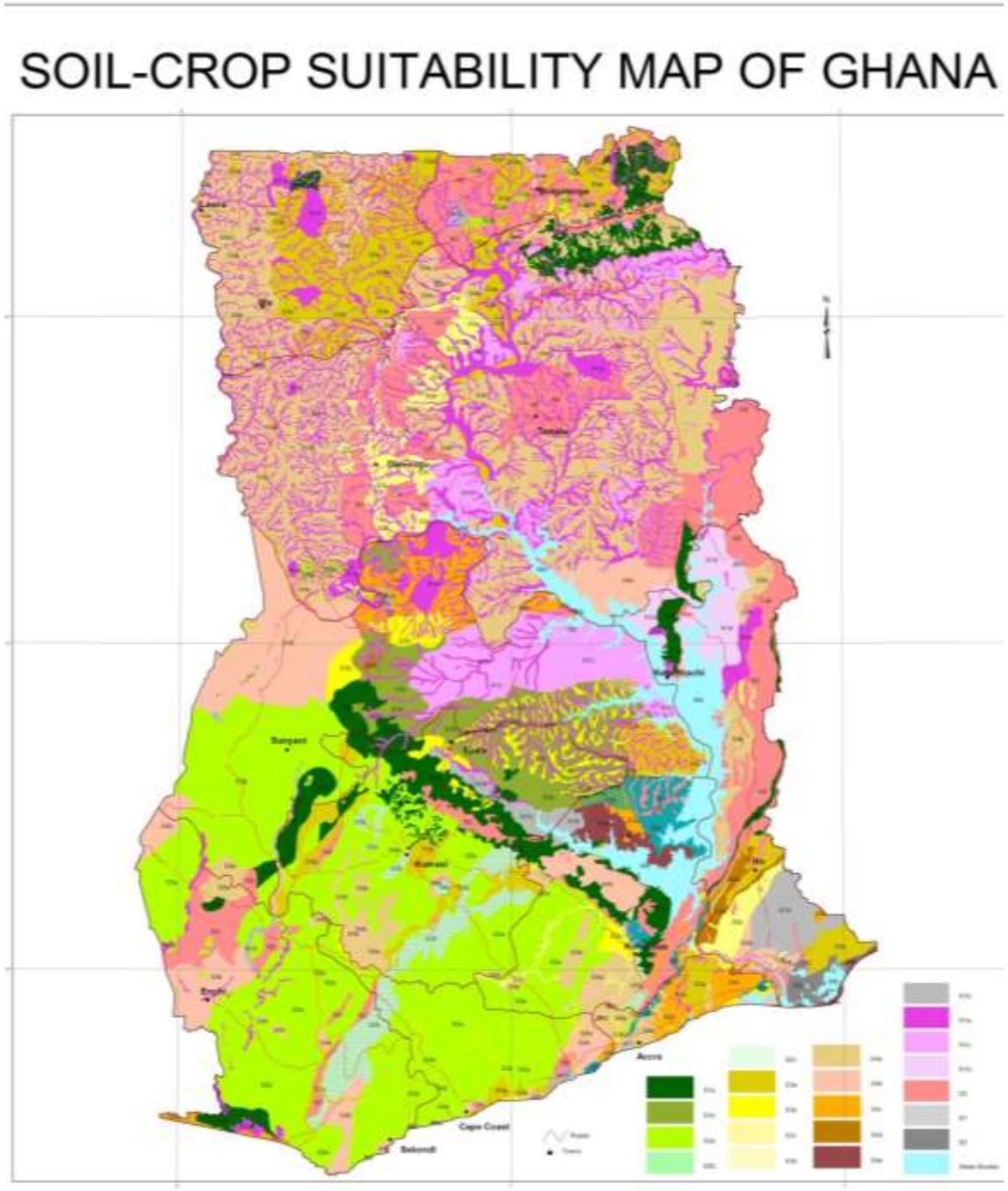
Source: Annual Report, CSIR-SRI and Fening et al., 2013.

Nutrient losses versus application rate



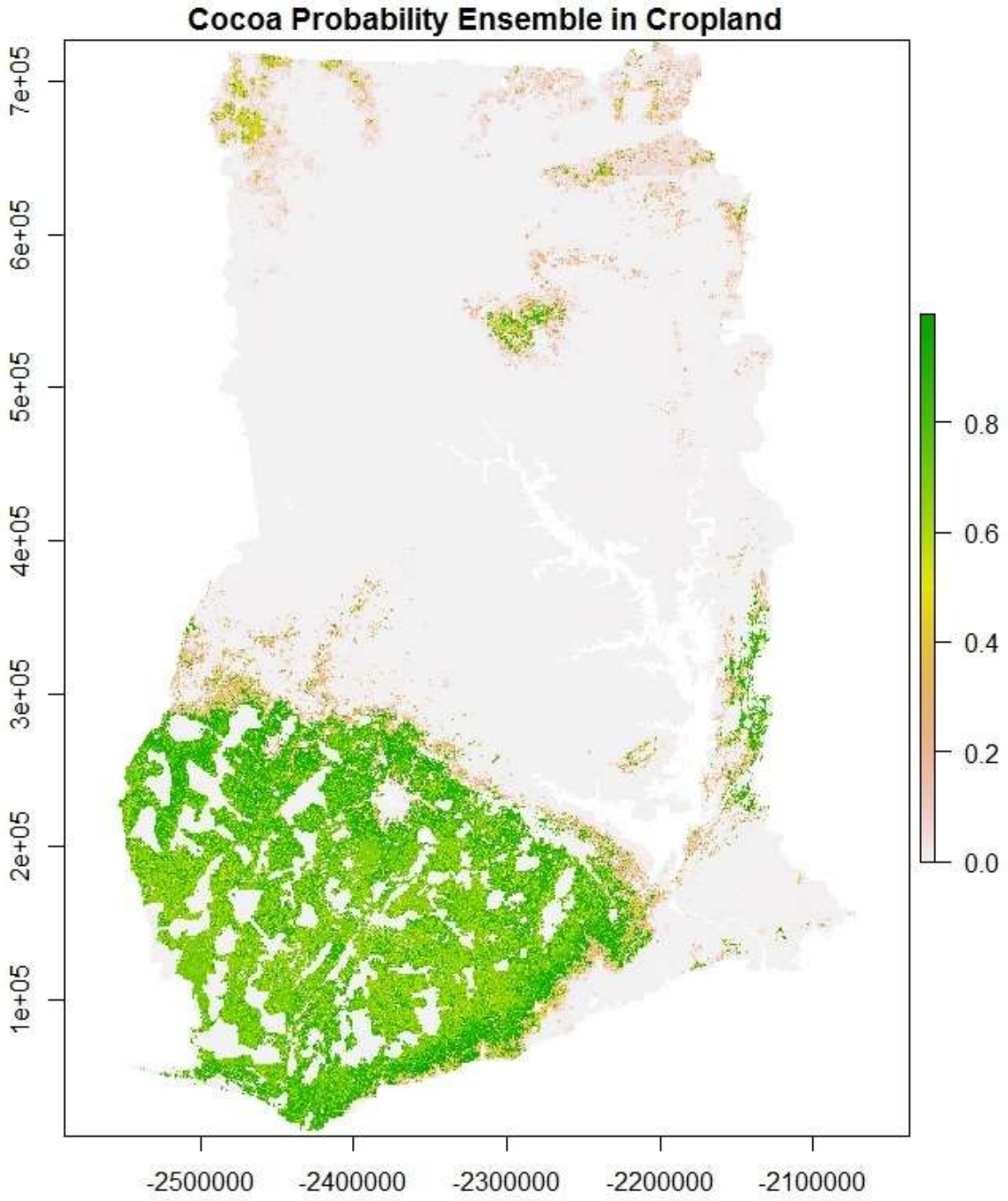
Soil Suitability Information

- What to grow and where for sustainable crop production



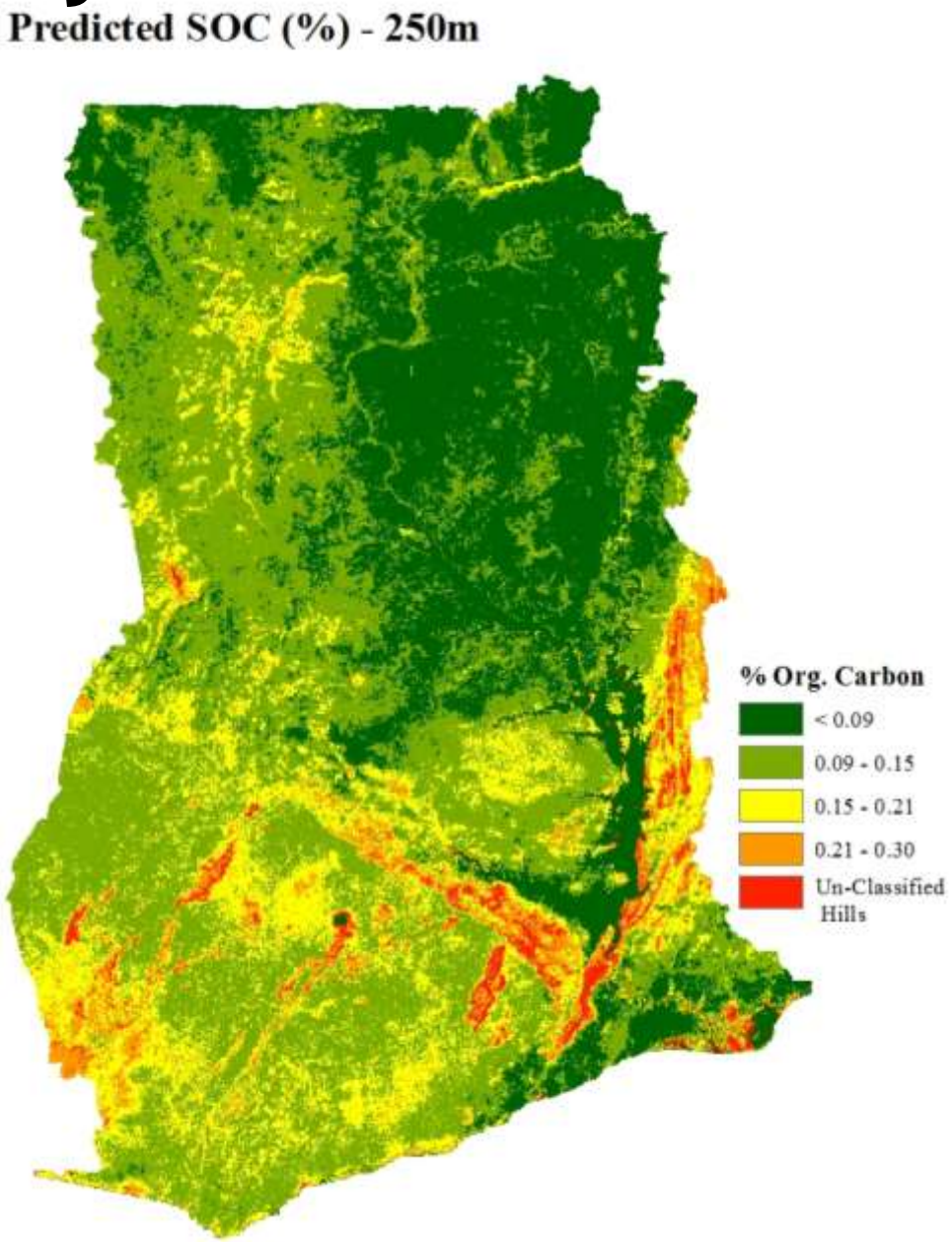
Crop Suitability Information

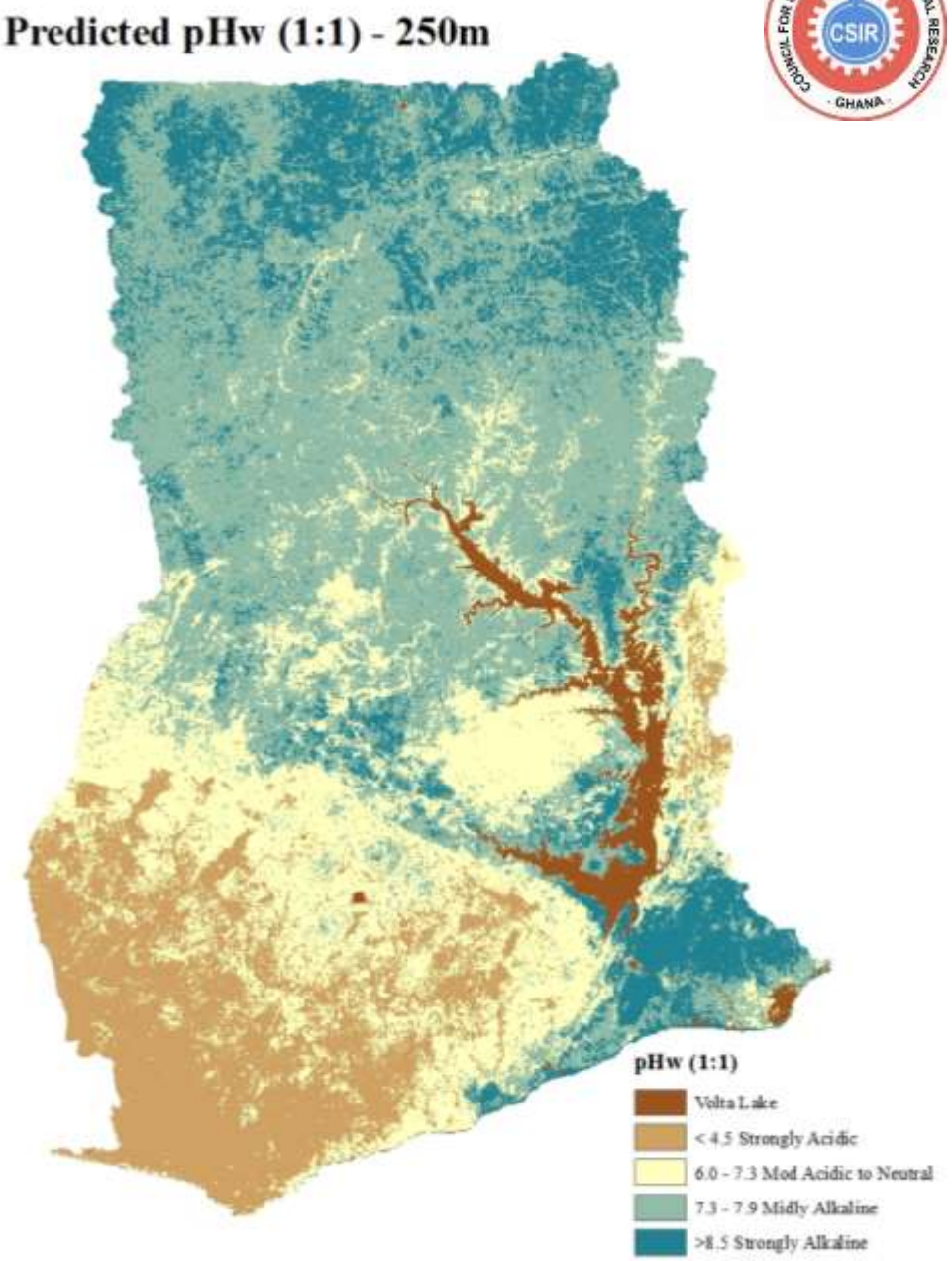
- Crop (Cocoa) Suitability Distribution



Soil Fertility Information

What fertilizer to apply where and at what rate for sustainable crop production





Improve agricultural productivity to buffer against high input prices

- Make soils more productive
- Improve efficiencies of inputs

Fertile Soil is Essential to Make it More Productive

Integrated Soil Fertility Management (ISFM)

Improvement in Crop Yield through ISFM* in West Africa

	Farmer's practice	After 4 years of ISFM
	Cereal yield (kg/ha)	
Maize	**750**	**2,750**
Sorghum	**1,000**	**1,800**
Cotton	**1,150**	**2,000**
Irrigated rice	**3,000**	**5,500**

Source: Henk Breman

* Integrated Soil Fertility Management

Improve Efficiency of Fertilizers

Fertilizer Deep Placement on Irrigated Rice: Point placement of urea super granules between rice plants 7-10 cm below the soil surface and 7 days after transplanting rice

Micro Dosing on Millet and Sorghum: Point placing 1 bottle cap (4.5g) of compound fertilizers for every plant stand to enhance fertilizer use efficiency and reduce crop failures in semi-arid areas

Source: IFDC

Improve Efficiency of Fertilizers (cont.)

Mali

FDP technology

Average Yield paddy	Results 2015/16 (demo plots)			
	FP	FDP	Δ	% Δ
Irrigated rice (kg/ha)	6,147	8,475	2,328	38%
Lowland rice (kg/ha)	1,455	2,687	1,232	85%

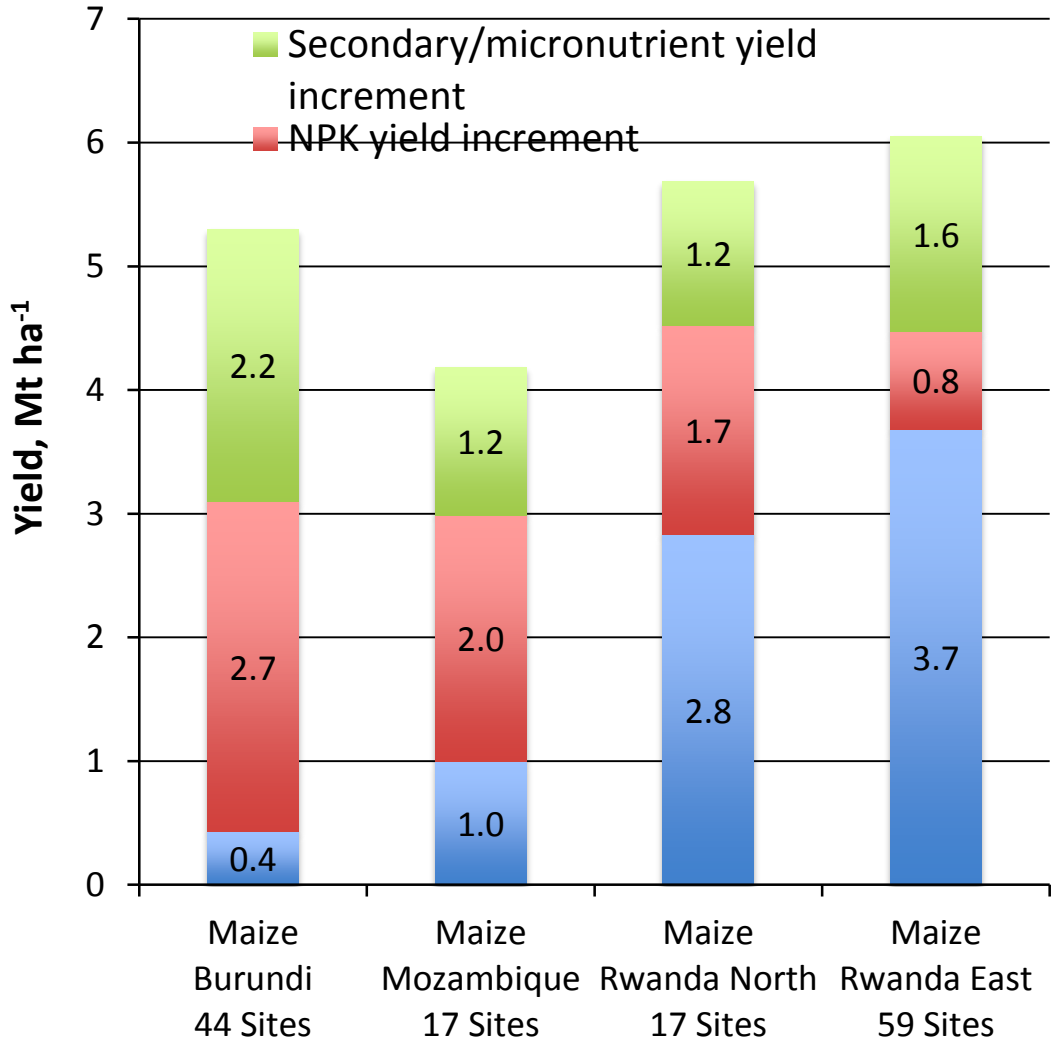
MD technology

Average Yield	Results 2015/16 (demo plots)			
	FP	MD	Δ	% Δ
Millet (kg/ha)	1,140	1,700	561	49%
Sorghum (kg/ha)	1,001	1,778	777	78%

Source: IFDC

Improving Efficiency of Fertilizers

Plant Nutrition Is More Than NPK



Extra 1.2-2.2 Mt/ha due to SMN addition

ASSESSMENT OF AREAS FOR BIOENERGY CROPS

In assessing whether a given physiographic land unit is suitable for the production of bioenergy crops, the following factors have been considered within the framework of land systems:

- Climate
- Size and distribution of the land system
- Soil limitations to crop growth
- Slopes in relation to erosion hazard
- Mechanization with tractors
- Present farming systems
- Existing extension coverage
- Communications

CONCLUSION

ECOWAS Bioenergy Policy is good but it should be implemented alongside with ECOWAS Fertilizer Policy

Integrated Soil Fertility Management (ISFM) is important to improve nutrient use efficiency

Considering the overriding role agriculture plays in the development of ECOWAS economies, strengthening
agricultural inputs and produce markets is central to West Africa's economic integration.

Increase agricultural production and crop productivity to increase farmers' income and reduce poverty to ensure food and nutrition security
Assist resource poor farmers to access quality seeds and fertilizers

CONCLUSION CONT…

Reassess subsidy package

Quantity and type of fertilizers should be based on soil test and crop requirement

Seed should be distributed in small packs (e.g., 2.5 kgs, 5 kgs , 10 kgs or 25kg) to make it affordable by small holder farmers

Develop nutrient-status maps of district and regions

THANK YOU

CSIR – SOIL RESEARCH INSTITUTE

eyeboah5@hotmail.com